

# **Analysis of Costs and Benefits to the City of Chicopee associated with Single Stream Collection of Recyclables.**

Final Report by:

DSM ENVIRONMENTAL SERVICES, INC.

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## **I. Introduction**

In accordance with our scope of work dated February 4, 2009, DSM Environmental Services, Inc. (DSM) completed an analysis of the potential costs and benefits to the City of Chicopee (City) associated with switching to single stream collection of recyclables. A Draft Report was issued in August, 2009. This Final Report has been updated to reflect CY 2009 costs and tonnage data.

Three major tasks were conducted to perform this analysis: a review and compilation of existing data on the current recycling program; on-site data collection on the recycling collection routes including timing and set-out counts; and an analysis of current costs and potential costs associated with switching from dual to single stream collection.

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## **II. Review and Compilation of Available Data**

DSM worked with the Chicopee Department of Public Works (DPW) to compile existing labor, truck, cost, weigh and housing data in order to build a simple recycling collection system cost allocation model using detailed data on the current recycling collection system. DSM did not collect data on Chicopee's refuse collection system, although estimates of avoided disposal cost savings associated with increase recycling have been made as part of DSM's analysis.

Base case data collected and used in the model includes:

- Households served – 18,800
- Tons collected for recycling – 2933 tons
- Average number of trucks used for recycling – 5, but use for recycling is every other week
- Typical method of collection – Collection from roughly 20 percent of households is performed using a split/dual stream truck picking up both paper and bottles/cans and collection from the other 80 percent is performed using two trucks (e.g. passed by twice, once for collection of paper and once for collection of bottles/cans)
- Number of recycling collection employees – 8, working recycling collection every other week
- Fully allocated recycling collection costs - \$373,500 (rounded) excluding capital costs and materials processing (see Table 3 for detailed costs)

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### III. On-Site Data Collection

One key element to DSM's analysis was the collection and analysis of actual route data on recycling set-outs and stop time. Actual route data are essential to understanding the baseline (existing) system, as well as to understanding the potential constraints on switching to single stream collection.

While DSM originally proposed to spend five person-days following recycling collection trucks to determine actual on-route ("productive") time and off-route ("non-productive") time, we ultimately spent 9 full person days timing collection trucks. DSM worked with the Collection Supervisor to select representative routes, trucks and drivers for route timing.

For each truck timed, DSM determined the amount of on-route and off-route time, the number of stops and setouts<sup>1</sup>, and the total weight of material collected. From this data DSM could calculate the average time per stop and set-out, and the average weight collected per set-out. Route data were also used to estimate monthly participation rates – although set-out rates and monthly participation are only peripherally related.

Because Chicopee does not collect data on the daily stops or setouts, these data were important to establish how set-outs and stops might change under single stream collection. While each set out counted represents a single household, because roughly 80% of the time households may have two trucks collect their recyclables (one for paper and a second for bottles and cans), DSM had to adjust collection time to account for the current two pass system.<sup>2 3</sup>

#### *Survey Methodology*

DSM arrived before the morning meeting where route assignments are given to drivers and laborers. DSM was assigned a driver and truck at the end of the meeting to time for the day. DSM recorded the date, day of the week, type of material to be collected, truck number and type of truck, driver and laborer name (if there was a second person on the truck), route name, time and odometer reading at the garage before the truck left for the route.

On route, DSM recorded the number of stops on right and left side of the truck, as well as the number of set outs collected on the right and left side of the truck. DSM also recorded the time the route was completed or stopped due to a full truck or break. DSM recorded all lunch, coffee or other breaks taken during the day. The odometer was taken when the route was stopped (or completed) and once again when the route was started. The time the truck arrived at the Materials Recovery Facility (MRF) was recorded along with the net weight of the recycled material collected. The time the truck left the MRF was recorded and the time back on the route or back to the garage was recorded.

DSM timed the three different truck types used. Two days of timing were conducted on the single side loader trucks, five days of timing were conducted on dual side loader trucks and two days of timing were conducted on the rear loader trucks.

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<sup>1</sup> One stop can have more than one household setting out recyclables. This is especially the case in multi-family housing areas. Stops are important for determining collection efficiency. Set-outs provide information from which the number of households participating in recycling can be estimated.

<sup>2</sup> A stop might include more than one household. DSM attempted to count stops as well as the number of households represented at each stop. Each household setting out material is a "set out".

<sup>3</sup> DSM estimated the percentage of households collected using two passes from reviewing truck use and weigh data provided by Chicopee DPW from January through April, 2009.



An effort was also made to collect data on representative routes and on each different method of material collection. Two days of timing were conducted on bottles and can collection (one day on a single side loader truck and one day on a dual side loader truck). Three days of timing were conducted on paper collection (2 days on a rear loader with a driver and helper and one day on a dual side loader with the driver acting as the collector) and two days timing were conducted on dual collection of bottles/cans and paper (one day on a dual side loader truck and one day on a single side loader truck). In addition, the City made arrangements with the Springfield MRF to collect material as a single stream with one day of timing using a rear loader with a driver and helper and a second day timing on a dual side loader (with a single driver).

Finally, DSM collected data on different days of the week including Monday, Tuesday, Wednesday and Thursday. In general, the days and routes chosen were reported by the Collection Supervisor to be representative of the City's current collection system.

## Results

Table 1, below presents the route data collected, and the subsequent analysis, to determine the current time per recycling set-out for paper only, bottles and cans only, two streams (in two compartments) and single stream material (in a single compartment truck).

**TABLE 1**  
**Collection Productivity Timing Data**  
**(April 8 – June 1, 2009)**

Truck	Driver/Labor	Total Time (hours:mins)	Non-prod (hours:mins)	Productive (hours:mins)	Daily Stops	Time / Stop (secs)	Set Outs	Time / Set Out (secs)	Wt / Stop (lbs)	Wt / Set Out (lbs)	Tons / Person	Tns / hr /person
Truck 4 - 4/8 P	Joe & Chris	7:25	1:55	5:30	630	0:00:31	670	0:00:30	19.71	18.54	3.11	0.56
Truck 10 - 4/21 P	Al	6:18	1:42	4:36	564	0:00:29	571	0:00:29	19.54	19.30	5.51	1.20
Truck 21 - 4/22 P	Steve & Chris	4:18	0:40	3:38	438	0:00:30	572	0:00:23	24.02	18.39	2.63	0.72
Truck 16 - 4/8 BC	Kevin	7:26	1:15	6:11	495	0:00:45	547	0:00:41	9.49	8.59	2.35	0.38
Truck 20 - 4/21 BC	John	8:06	1:42	6:24	767	0:00:30	785	0:00:29	7.72	7.54	2.96	0.46
Truck 15 - 4/22 M	Sean	6:17	1:44	4:33	306	0:00:54	364	0:00:45	19.08	16.04	2.92	0.64
Truck 20 - 5/7 M	John	6:16	1:33	4:43	325	0:00:52	416	0:00:41	22.03	17.21	3.58	0.80
Truck 4 - 5/7 SS	Joe & Chris	6:33	1:14	5:19	494	0:00:39	632	0:00:30	26.23	20.51	3.24	0.64
Truck 10 - 6/1 SS	Al	8:02	1:30	6:32	628	0:00:37	641	0:00:37	20.57	20.16	6.46	0.99

Descriptions and photographs of the types of trucks timed in Chicopee, and the truck numbers corresponding to Table 1 above, are found below.

**Single Side Loader:** Dual side drive trucks with a loading tray lift on the right side of the truck. These trucks have a compactor body and an interior divider to keep paper separate from the bottles and cans. The lift bucket is separated with a divider so materials put into the front of the bucket will be loaded in the front of the truck before the interior divider and materials put into the back of the bucket will be loaded into the back of the truck behind the interior divider. These trucks can collect one type of material by placing it on both sides of the interior divider. These trucks typically utilize the driver as the recycling collector. DSM timed single side loading **truck number 20 for Chicopee.**





**Dual Side Loader:** Dual side drive trucks with side loading tray lift on both sides of the truck. The truck bodies are outfitted the same as the single side loading trucks described above. These trucks can be operated by a single driver/collector, or operated with a driver and a laborer. Dual side loading facilitates collection on both sides of a street with a single pass. DSM timed dual side loading **truck numbers 16, 10 and 15.**



**Rear Loader:** Conventional left hand side drive, garbage compaction trucks loaded from the rear. Chicopee's rear loading trucks do not have an interior divider; therefore they can only collect one type of material under dual stream collection. These trucks are typically operated with a driver and one laborer. Chicopee utilizes these rear loaders primarily for paper collection on the recycling routes in Chicopee. While currently not configured this way, Chicopee's rear loaders can also be specified with an internal divider to collect two separate materials, and can be outfitted with cart tippers for emptying rolling carts. DSM timed rear loading **truck numbers 4 and 21.**



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## IV. Base Case Analysis

The base case analysis describes current collection in Chicopee and is divided into three components: collection efficiency; household set out and participation rates; and, current costs. Each is described below.

### *Collection Efficiency*

The DPW currently collects refuse and recyclables from an estimated 18,800 households. Each household receives weekly refuse collection and every other week recycling collection (yard waste is collected on alternating weeks from recycling most of the year). The DPW collects recyclables over five days every other week, collecting from an average of 3,760 households each day, using an average of five trucks per day. A combination of side loading recycling trucks used exclusively for recycling collection, and rear loading refuse trucks which are used for yard waste or refuse when not used for recycling, are used for collection.

Recyclables are currently set out and collected in two streams – paper, and bottles/cans. Some recyclables are collected in dual stream trucks, with paper placed in one-half the truck and bottles/cans in the other half, and the remainder is collected using two trucks, one for paper and one for bottles/cans. Based on truck usage data provided by Chicopee, DSM estimates that 81 percent of the stops are collected by two trucks, with the remaining 19 percent collected by a single, dual compartment truck.

Based on both timing and truck usage data, DSM estimates that on average 353 households, representing 317 stops, are served by each of the five trucks, each collection day. As illustrated by Table 2, below, timing data showed the average truck makes 533 stops to collect 586 set-outs per day. However, because 81 percent of the set-outs are a single material, the average number



of stops and set-outs must be adjusted down to reflect the fact that 81 percent of the set-outs must be collected by two trucks.

**TABLE 2**  
**Average Timing Data by Truck Type, and Fleet Average**

Truck	Total Time (hours:mins)	Non-prod (hours:mins)	Productive (hours:mins)	Daily Stops	Time / Stop (secs)	Set Outs	Time / Set Out (secs)	Wt / Stop (lbs)
Paper Avg	6:00	1:25	4:34	544	0:00:30	604	0:00:27	21.09
BC Avg	7:46	1:28	6:17	631	0:00:38	666	0:00:35	8.61
Mixed Avg	6:16	1:38	4:38	316	0:00:53	390	0:00:43	20.56
SS Avg	7:17	1:22	5:55	561	0:00:38	637	0:00:33	23.40
<b>Average Fleet (1):</b>	<b>6:45:50</b>	<b>1:29:22</b>	<b>5:16:28</b>	<b>533</b>	<b>0:00:38</b>	<b>586</b>	<b>0:00:33</b>	<b>16</b>

(1) Based on two paper, two BC (bottle and can) and one mixed (dual stream) truck collecting recyclables each collection day.

The average truck is out of the garage for 6 hours and 46 minutes (rounded), of which 5 hours and 16 minutes (rounded) are spent on route collecting recyclables (productive time) and 1 hour and 29 minutes are spent driving to and from the routes, delivering material to the MRF, and on breaks (non-productive time). Thus, the average truck is productively collecting recyclables 78 percent of the work day. This is a significant improvement in productivity when compared to the last time that DSM timed Chicopee recycling collection trucks in 1992, when the average Chicopee recycling truck was productively collecting recyclables only 62 to 64 percent of the time.<sup>4</sup>

Finally, the average stop time is estimated to be 38 seconds. Adjusted for the number of set-outs per stop, average stop time per set out is estimated to be 33 seconds. This compares to a total time per stop of 41.4 seconds per stop recorded in 1992. Thus, Chicopee has improved on both the amount of productive time, and the average stop time since 1992.

However, because DSM estimates that 81 percent of set outs require two stops – one for paper and one for bottles/cans, the average combined stop time is one minute and three seconds, accounting for the mix of single stops and two stops per set out. (This can also be expressed as 56 seconds per set out.) This is one of the areas where single stream collection can potentially provide significant savings to Chicopee.

### **Household Participation**

During the nine days of timing DSM attempted to record the number of households setting out recyclables. This is typically greater than the number of stops the truck makes because at some stops more than one set out of recyclables is collected. This is especially the case in areas where there is multi-family housing and limited sidewalk/curbside on which to set out material.

Set-out data measure how many households are setting out recyclables on any given day. However, participation rates are typically measured in terms of monthly household participation. Because not every participating household sets out recyclables each collection day, the set out rate has to be adjusted up to estimate monthly participation.

DSM has conducted a limited number of studies designed to estimate monthly participation from weekly set-out counts. This includes the 1992 *Springfield Model Cities* study which compared

<sup>4</sup> *Springfield Model Cities Program, Final Report to the American Plastics Council*, June, 1993, prepared by DSM Environmental Services, Inc.



weekly set outs in Chicopee with every other week collection and set outs in Springfield<sup>5</sup>, and a more recent study for the East Central Iowa Council of Governments (ECICOG).<sup>6</sup> The ECICOG data indicate that weekly set out rates ranging from 25 to 60 percent should be adjusted up by 150 percent to estimate monthly participation rates. The Springfield data, on every other week collection, indicate that 75 percent of participating households set out recyclables in any given collection week.

These two studies form at least an historical basis for estimating Chicopee's participation rate. However, the Iowa data is primarily from weekly collection programs and the 1992 Springfield study is relatively old, with significant increases in the amount of plastic (and therefore volume of material) available for recycling subsequent to 1992.

Given the lack of data on monthly participation rates for Chicopee, and the importance of set out rates and participation rates to the analysis of the impact of switching to single stream collection, DSM has chosen to estimate monthly participation rates based on the historical data.

Adjusting the observed average of 47 percent of households setting out recyclables over the nine days of route timing in Chicopee using the ECICOG formula, results in an estimated monthly participation rate of 70 percent. Adjusting the 47 percent set out rate to assume that 75 percent of participating households set out recyclables on each collection day (based on the 1992 Springfield data) results in an estimated monthly participation rate of 63 percent. Therefore, it is likely that the actual monthly participation rate for Chicopee ranges between 63 and 70 percent. Given the uncertainty in both the actual set out count (it is sometimes difficult to know how many households have set out material at the same stop, especially in multi-family areas) and the correct adjustment factor, DSM has estimates that roughly 65 percent of Chicopee households are currently participating in the recycling program on a monthly basis.

Assuming a 65 percent monthly participation rate, and knowing that 3,140 tons were collected for recycling last year, the average participating household is setting out 534 pounds of recyclables per year. This is important, as discussed below, when comparing the current dual stream collection program using blue bins with single stream collection using either blue bins or carts. Single stream collection has been shown to increase the quantity of material set out by participating households (in addition to increasing participation) and the combination of single stream collection and rolling carts further increases both participation and the quantities set out per participating household. These factors are addressed below in the analysis of alternatives.

### **Baseline System Costs**

The DPW provided DSM with detailed data on current recycling operational costs. These included labor, equipment operating and maintenance costs, and administration and overhead costs. The DPW also provided DSM with the capital cost of three, new rear loading compactor trucks that Chicopee recently purchased. However, because Chicopee does not maintain a formal capital reserve or equipment replacement cost as part of annual operating costs and instead, relies on Chicopee City Council voted appropriations to fund DPW equipment requests, DSM has reported baseline costs with and without capital costs.

Other relevant costs and revenues associated with Chicopee's recycling program include an adjustment to reflect avoided landfill tipping fees for every ton of material diverted for recycling, and MRF processing fees and material revenues.

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<sup>5</sup> In 1992 Chicopee collected recyclables weekly and Springfield collected recyclables every other week. At that time only 34 percent of participating households set out recycling every week, while in Springfield 75 percent of participating households set out recycling every other week.

<sup>6</sup> *Evaluation of Recycling Programs, East Central Iowa Council of Government*, Final Report, March, 2003, DSM Environmental Services, Inc.

Table 3 summarizes Chicopee's costs for the current recycling program. As illustrated by Table 3, current annual operating costs total \$373,583. Adding in amortized truck costs (to be consistent with the cost analysis of alternatives presented below) increases total current annual costs to \$437,918 dollars.<sup>7</sup>

These total costs can then be adjusted down to reflect avoided disposal fees for the 2,933 tons diverted at \$100,866 and the \$76,258 in materials revenue received by Chicopee from the MRF.

This yields a net cost of Chicopee's residential recycling program of \$260,794.

**TABLE 3**  
**Summary of Current Costs (CY 2008)**

<b>Cost Category</b>	
Labor	\$215,015
Overtime	\$17,500
Supervisory	\$30,000
Truck O&M	\$82,718
Allocated Garage Costs	\$28,350
<b>Sub-Total, O&amp;M Costs</b>	<b>\$373,583</b>
 <b>Amortized Capital</b>	 \$64,335
<b>Sub-Total, Costs</b>	<b>\$437,918</b>
 <b>Less Avoided Costs and Revenues</b>	
Avoided Tipping Fees	(\$100,866)
Material Revenues	(\$76,258)
<b>Net Cost</b>	<b>\$260,794</b>

## **V. Analysis of the Impact of Switching to Single Stream Collection**

DSM used the base case collection model to develop alternative collection cost estimates associated with implementation of single stream collection, with and without rolling carts.

In the end, four alternatives were analyzed:

- Single stream collection using conventional rear loading packers and the existing recycling bins;
- Single stream collection using conventional rear loading packers and 64 gallon rolling carts, loaded using cart tippers (semi-automated collection);
- Single stream collection using side loading, single compartment, compacting trucks and the existing recycling bins; and,
- Single stream collection using side loading, single compartment, compacting trucks and recycling carts and a cart tipper and/or automated collection, depending on the route.

The same variables discussed under the base case are important in the analysis of alternatives. These include:

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<sup>7</sup> This total annual cost does not include the cost of the recycling coordinator or DPW director time, which are assumed to not change with the potential addition of single stream recycling.



- The number of households participating under a single stream collection system, the amount of material they set out for recycling, and the frequency of setting out material;
- The time necessary to collect the material, either with or without carts which is impacted by the collection method (e.g. trucks and containers used) as well as the driver, laborer and route types; and,
- Any additional capital and operating costs associated with collecting single stream material.

Each of these key variables is discussed in detail, below.

### ***Household Participation and Set out Quantities***

DSM has measured participation and set outs during the shift from dual stream to single stream collection, and with and without carts in different geographic locations. In general, single stream recycling – where the household can place all recyclables together without having to separate paper from bottles/cans -- increases both the number of households willing to participate in recycling, and the amount of material that a participating household places out for recycling (capture rate).

The addition of a rolling, 64 gallon (typically) cart increases both participation and, more importantly, capture rates from participating households, by providing sufficient, enclosed storage capacity to hold all of a households' recyclables. This is especially critical when recycling is offered every other week (as it is in Chicopee), and households must store material for two full weeks in between collections while refuse is collected weekly.

Based on DSM's data from other cities, DSM has made the following assumptions about household participation and capture rates:

- Participation rates, and pounds per participating household, will increase by 5 percentage points if Chicopee implements single stream recycling but continues to collect the recyclables in the existing blue bins every other week.
- If Chicopee provides rolling, 64 gallon carts to all participating households, participation rates are estimated to increase by an additional 15 percentage points – to 85 percent participation; and pounds per participating household will increase by 100 pounds per year – due to the increased storage capacity of the carts. The set-out rate will decline slightly, however, due to the amount of storage capacity.
- Set out quantities are also expected to increase. It is assumed that if Chicopee switches to single stream collection, but continues with the existing blue bins, that participating households will increase the amount of material set out on an annual basis by roughly 5 percentage points.
- If Chicopee provided 64 gallon rolling carts to participating households, DSM assumes that participating households will increase the amount of material they recycle by an additional 20 percentage points.
- The net result of increased participation and increased quantities per participating household is that overall tonnage will increase from the baseline of 3,140 tons to 3,760 tons with single stream and the existing blue bins, and to 5,640 tons with single stream and 64 gallon rolling carts.

Table 4 summarizes the estimated changes in participation and set out quantities DSM believes are reasonable to expect with a change to single stream collection, with and without carts.



**TABLE 4**  
**Expected Change in Household Participation and Set out Quantities**

	Baseline	SS w/ Blue Bins	SS w/ Carts
Total Households	18,800	18,800	18,800
Percent Participating	65%	70%	85%
Set Out Rate	75%	75%	75%
Pounds per Set Out (lbs)	27	29	36
Pounds per Participating Household Per Year (lbs)	534	571	706
Total Tons Collected Per Year (tons)	3,140	3,760	5,640
Pounds Per Total Households (lbs)	334	400	600

### ***Collection Time***

Collection time is a function of the number of household set outs, and the time required at each stop to pick up the set out. Assuming that Chicopee continues to collect the material from the existing blue bins, then the set out rate will increase commensurate with the increased participation (assumed to be 5 percentage points).

Collection time will also depend on the type of truck used for collection.

DSM has assumed that collection time for single stream material set out in blue bins, with conventional rear loading packer trucks with one driver and one laborer, will remain, on average, the same as it currently is, at 33 seconds per set-out. The difference is that there will be no need to use two trucks to collect material, so that total collection time per set-out collected is reduced from 56 to 33 seconds per set-out, resulting in a reduction of an average of one truck per day collecting recyclables.

DSM has assumed that if Chicopee switches to right side drive, right hand side loading trucks with a single driver/collector, collection time will be reduced to 30 seconds per stop. In addition, a single driver/collector could be used, reducing labor requirements as well as the number of trucks.

Further, because all material can now be collected at one stop, and can be compacted on-route, the amount of on-route productive time should increase. For purposes of this analysis, DSM has used the non-productive time measured by DSM of the rear loading compactor truck to represent the potential reduction in non-productive time associated with on-route compaction of all materials.

The net result is that the switch to single stream collection of blue bin material should allow Chicopee to reduce the number of trucks from five to four, on average, for each recycling collection day. The total collection day could also be reduced by roughly one hour per day, significantly reducing overtime costs.

### ***Impact of Adding 64 Gallon, Rolling Carts***

As discussed above, the provision of 64 gallon, rolling carts significantly increases participation, and quantities collected per participating household. This has three significant impacts on collection.

First, collection time would increase significantly, requiring 5 trucks per day, and increasing the average collection day, and resultant overtime costs. That is because semi-automated collection of rolling carts using cart tippers requires that the cart be rolled to the truck, tipped using the cart tipper, and then rolled back to the curbside which increases the time to serve each household. Based on limited observations in other cities, DSM has assumed that semi-automated collection will increase to 44 seconds per set out when using a rear loading compactor truck, and to 38 seconds per set out when using a side loading truck. This increases the total work day by an estimated 1 hour and 15 minutes per day using a conventional rear loader, resulting in an average work day of 8 hours and 13 minutes.

However, the increased recycling collection time could be off-set by a reduction in refuse collection time because DSM estimates that roughly 2,000 tons of material currently collected as refuse will now be collected as recyclables. While DSM did not analyze Chicopee's refuse collection system, it is possible that Chicopee could shift some refuse collection time to recycling collection time – since the same trucks would be used for both, especially at the end of the day, reducing overtime and increasing overall collection efficiency.

Third, the estimated increase in recycling tonnage could produce significant avoided disposal cost savings over time. As discussed below, Chicopee currently enjoys a very low tipping fee, \$33.58 per ton, as the host community for a private landfill. Current projections are that this landfill will close within the next five years, at which time Chicopee would be forced to pay market rates, which are now more than double Chicopee's current rate. Thus, the increased diversion associated with carts could become significantly more cost effective five years from now, when the avoided cost associated with the diversion of 2000 additional tons of refuse to recycling would be more than double what is shown in the cost model.

Shifting to semi-automated collection using side loading trucks reduces collection time when compared to the use of conventional rear loading compactor trucks, but still increases collection time by roughly 20 minutes per day over baseline. Therefore, if Chicopee considers moving to rolling, 64 gallon carts, Chicopee should also consider phasing in fully automated collection in those areas of the City where it is feasible. Per stop collection times for fully automated trucks can be less than 30 seconds per stop once drivers are fully trained.

Table 5, presents the key collection productivity comparisons between the current baseline system and the single stream collection systems analyzed for this report.

**TABLE 5**  
**Expected Change in Collection Productivity, Single Stream Collection**

Collection Productivity	Baseline (1)	Single Stream Options			
		SS, Rear Load	SS, Side Load	SS with Carts, Rear Load	SS with Carts, Side Load
Time Per Set-Out (seconds)	0:00:56	0:00:33	0:00:33	0:00:44	0:00:38
Number of Trucks Required	5	4	4	5	5
Productive Time (hours)	5:27:58	4:35:00	4:35:00	6:43:20	5:48:20
Non-Productive Time (hours)	1:29:22	1:15:00	1:15:00	1:29:22	1:29:22
Total Collection Day	6:57:20	5:50:00	5:50:00	8:12:42	7:17:42

(1) Time per set-out reflects the fact that on 81 percent of stops two trucks are required



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## VI. Estimated Impact on Costs

The estimated costs associated with a potential shift to single stream collection include the following:

- Labor is a critical component of current (baseline) costs, representing between 49 and 58 percent of total costs (inclusive and exclusive of capital, respectively). Therefore one key issue associated with a potential switch to single stream collection is the impact on labor costs. As illustrated by Table 6, the amount of labor depends on the collection trucks used. Exclusive use of conventional rear loading refuse trucks to collect single stream recyclables reduces the potential savings because the City will end up with a need for a laborer for each truck when the side loading, dual compartment trucks are eliminated. One way to reduce labor costs would be to switch to side loading compaction trucks for recyclables, which could then be used for yard waste or refuse on alternating weeks. This would allow the City to use four driver/collectors for recycling in place of the eight total drivers and collectors currently used for recycling.
- The increased tonnage associated with the switch to single stream recycling increases the savings from avoided landfill tip fees. However, Chicopee's current tipping fee of \$34.39 is significantly below market rates. At the time that the existing landfill closes (currently assumed to be within five years in 2014), avoided disposal costs will more than double, to around \$75 per ton, significantly increasing landfill savings. As discussed above, an increase in tipping fees to market rates would justify the increased costs associated with the introduction of rolling carts, even with the increased collection times associated with semi-automated collection.
- Current material revenue of \$26 per ton for all material delivered to the Springfield MRF significantly impacts on the net cost of recycling in Chicopee. Given what has occurred with materials prices over the past year, it is unlikely that municipalities using the Springfield MRF would receive the same type of contractual guarantee going forward. Instead, it is likely that the next contract will be based on a specified tipping fee for processing and material revenue sharing. It is likely that the switch to single stream recycling will reduce revenues because of higher processing costs. However, it is difficult to predict what the change in revenues and costs will be. For purposes of this analysis DSM has assumed a \$10 per ton reduction in materials revenues.
- As discussed under the baseline cost discussion, the way that Chicopee handles capital investments makes it difficult to fairly compare the cost of switching to single stream recycling – especially if a decision is made to provide 64 gallon rolling carts. The cost of new trucks and the cost of carts significantly impacts on the cost of single stream recycling when compared to the current system where capital costs are relatively minor given Chicopee's lack of a capital replacement program.

Given these caveats with respect to the cost comparison, Table 6 compares the four single stream collection alternatives against baseline (current) costs. As illustrated by Table 6, single stream collection is estimated to save Chicopee \$43,000 (rounded) on an annual basis assuming that Chicopee chooses to increase its fleet of conventional rear loading packer trucks to collect recyclables.

Savings are greater, estimated at \$100,000 per year if Chicopee replaces its current recycling collection trucks with side loading compactor trucks, and uses a single driver/collector to collect the single stream material.

Holding costs equal, and increasing the tipping fee to a market rate of \$75 per ton generates costs savings of between \$137,000 and \$192,000, even with the significant investment in 64 gallon carts.

**TABLE 6**  
**Estimated Change in Costs, Single Stream Collection**

<b>Cost Category</b>	<b>SS, Rear Load</b>	<b>SS, Side Load</b>	<b>SS with Carts, Rear Load</b>	<b>SS with Carts, Side Load</b>
	<b>(\$)</b>	<b>(\$)</b>	<b>(\$)</b>	<b>(\$)</b>
Labor	\$208,066	\$115,839	\$261,406	\$198,624
Overtime	\$14,676	\$14,676	\$20,660	\$18,354
Supervisory	\$30,000	\$30,000	\$30,000	\$30,000
Truck O&M	\$62,750	\$62,750	\$72,536	\$72,536
Allocated Garage Costs	\$28,350	\$28,350	\$28,350	\$28,350
<b>Sub-Total, O&amp;M Costs</b>	<b>\$343,842</b>	<b>\$251,615</b>	<b>\$412,951</b>	<b>\$347,863</b>
Amortized Capital	\$63,565	\$98,985	\$223,765	\$234,316
<b>Sub-Total, Costs</b>	<b>\$407,407</b>	<b>\$350,600</b>	<b>\$636,716</b>	<b>\$582,178</b>
<b>Less Avoided Costs and Revenues</b>				
Avoided Tipping Fees	-\$129,306	-\$129,306	-\$193,960	-\$193,960
Material Revenues	-\$60,160	-\$60,160	-\$90,240	-\$90,240
<b>Net Cost</b>	<b>\$217,941</b>	<b>\$161,133</b>	<b>\$352,516</b>	<b>\$297,979</b>
<b>Comparison With Baseline</b>	<b>\$260,794</b>	<b>\$260,794</b>	<b>\$260,794</b>	<b>\$260,794</b>
<b>Estimated (Savings) or Cost</b>	<b>(\$42,853)</b>	<b>(\$99,661)</b>	<b>\$91,723</b>	<b>\$37,185</b>

The cost of purchasing carts, which DSM estimates would significantly increase quantities recycled, overwhelms the expected savings in avoided tipping fees and increase material revenues. However, as noted above, if Chicopee's tipping fees were to double, Chicopee would realize significant savings associated with the switch to single stream collection and carts.

## **VII. Implementation**

Given the immediate savings associated with switching to single stream collection using existing trucks, and the expected closure of the Chicopee landfill within five years, it is logical for Chicopee to begin the transition to single stream collection, and eventually to carts over the next five years.

Implementation can be phased in roughly as follows:

- Negotiate processing contract for delivery of single stream material
- Begin replacement of dual compartment side loading recycling trucks with side loading compactor trucks equipped with cart lifters. These trucks can be used for recycling, yard waste and refuse, and can be tested against both rear loading compaction trucks, and, in the future, against fully automated collection trucks.



- Begin a five year cart purchase and roll-out program, assuming roll-out by collection day. Cart costs can be reduced by delivery of a cart only to households who request the cart (assumed to be 80% of households over the five year period).
- Budget roughly 50 cents per household for a public education and awareness campaign designed to educate residents about single stream recycling, and the availability of carts.

Table 7 presents a proposed capital budget for the implementation steps listed above. It should be noted that replacement of trucks is on-going in Chicopee, irrespective of whether single stream recycling is implemented or not. Further, the intent of this proposed capital budget for the switch to single stream recycling is to have completed the switch, and therefore increased diversion through recycling, before the landfill is closed, which is currently projected for 2016 or 2017.

Once carts have been purchased for single stream recycling, and all of the collection trucks are capable of tipping carts, Chicopee should consider the purchase of 64 gallon carts for refuse with the goal of reducing refuse collection costs when tipping fees increase with the closure of the landfill.

TABLE 7					
Proposed Capital Budget, Switch to Single Stream Collection and Carts					
Task/Year	Year				
	2010	2011	2012	2013	2014
Negotiate SS Processing at MRF	no cost				
Add Cart Tippers to Existing Rear Load Trucks		\$10,000	\$10,000		
Purchase Side Loading Truck w/Cart Tipper	\$240,000	\$240,000	\$240,000	\$240,000	\$240,000
Purchase 64 gallon carts	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000
Educational and Promotional Campaign		\$10,000	\$10,000	\$5,000	\$5,000

## APPENDIX A

### Truck Types Potentially Available for Recycling Collection

The following trucks could be utilized in Chicopee for single stream collection.

**Side Loading Compaction** – These trucks typically are dual side drive, right hand side low entry trucks with a compaction body that loads from the right side just behind the driver. This allows the driver to act as the collector, while providing similar compaction capabilities to a rear loading truck. These trucks can be specified with an internal divider to collect two separate materials, or as a single compartment truck. The low loading height of the hopper also allows for installation of a cart tipper for collection of rolling carts.



**Automated Side Loaders** – These trucks are dual drive trucks outfitted with a lifting arm for collecting rolling carts. The lifting arm is operated by the driver from the cab of the truck, extending out to the rolling cart, clamping the cart, lifting and emptying the cart into the hopper, and replacing the cart on the street. These automated trucks can collect refuse or recyclables, and can be specified as single or dual compartment compaction trucks.

